ENCLOSURE 1

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

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Licensee:	Arizona Public Service Company
Facility:	Palo Verde Nuclear Generating Station, Units 1, 2, and 3
Location:	5951 S. Wintersburg Road Tonopah, Arizona
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Team Leader:	R. Correia, Chief, Maintenance and Reliability Section Quality Assurance and Maintenance Branch Office of Nuclear Reactor Regulation
Assistant Team Leader:	J. Whittemore, Reactor Inspector, Region IV
Inspectors:	W. Holland, Senior Resident Inspector, Region II R. Langstaff, Reactor Inspector, Region III W. McNeill, Reactor Inspector, Region IV J. Williams, Reactor Inspector, Region I
Approved By:	Dr. Dale A. Powers, Chief, Maintenance Branch Division of Reactor Safety

ATTACHMENTS:

Attachment 1:	Partial List of Persons Contacted List of Inspection Procedures Used List of Items Opened
Attachment 2:	List of Procedures Reviewed

EXECUTIVE SUMMARY

Palo Verde Nuclear Generating Station, Units 1, 2, and 3
NRC Inspection Report 50-528/96-09; 50-529/96-09; 50-530/96-09

This inspection included a review of the licensee's implementation of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance At Nuclear Power Plants" [the Maintenance Rule]. The report covers a 1-week period of inspection by inspectors from the Office of Nuclear Reactor Regulation and Region I-IV.

Operations

- Licensed operators demonstrated an understanding of their specific duties and responsibilities for implementing the Maintenance Rule. However, their general understanding of the Maintenance Rule was weak (Section O4.1).

Maintenance

- All required structures, systems, and components except the radwaste building were included within the scope of the Rule, although it was included in the structures monitoring program. After discussions with the inspectors, the licensee included it within the scope of the Rule (Section M1.1).

- Plans for performing the periodic evaluation met the requirements of the Rule (Section M1.3).

- The approach to balancing reliability and unavailability was reasonable. However, the use of goals and performance criteria that differed from the original probabilistic risk assessment assumptions could limit the effectiveness of this approach (Section M1.4).

- Reasonable goals or performance criteria that took safety into consideration were set for most structures, systems, and components (Section M1.6).

  The following exceptions were noted:

  - The selected performance criteria for the containment and other structures and the lack of clear guidance for placing structures, systems, and components in Category (a)(1) or (a)(2) was a weakness and is an unresolved item.

  - The use of a quarterly failure trend data collection report to identify functional failures for the pressurizer and reactor vessel vent system was a weakness.

- The selected plant level performance criteria and monitoring for the steam bypass control system that did not reflect the actual ongoing system level monitoring and corrective actions was a weakness.

- Predictive monitoring and trending of appropriate parameters was being appropriately performed. Structures, systems, and components performance monitoring using functional failures and conservative trigger values in conjunction with performance criteria was considered a strength of the licensee's program. The use of a centralized data collection group to help ensure consistency and the collection of demand data (in addition to failure data) was considered a strength of the licensee's program (Section M1.6.b.3).

- Maintenance and system engineers were very knowledgeable of their assigned systems and proactive in the development and implementation of corrective actions related to their systems. Root-cause analysis and corrective actions appeared to be a strength of the licensee's maintenance program (Section M1.6.b.4).

- In general, the material condition of the selected systems examined during the inspection was satisfactory. The gas turbines were in exceptional condition (Section M2).

- The scope of Self-Assessment Audit 96-020 was comprehensive and provided meaningful feedback to management (Section M7).

Engineering

- The risk determination process for structures, systems, and components was being performed in a satisfactory manner by an experienced and knowledgeable staff. Some weaknesses and strengths were noted (Section M1.2).

- The performance of plant safety assessments before taking equipment out-of-service was adequate. However, there was a weakness in the plant configuration risk indicator matrix that was used as part of these assessments. There was a potential for nonconservative estimates of risk associated with certain plant configurations and some balance-of-plant systems were not modeled in the probabilistic risk assessment (Section M1.5).

- Industry-wide operating experience was appropriately taken into consideration when setting goals and performance criteria (Section M1.6.b.2).

- All maintenance and system engineers interviewed were very knowledgeable of their assigned systems and demonstrated sufficient knowledge to adequately implement their responsibilities under the Maintenance Rule. However, some weaknesses in engineering staff knowledge of certain aspects of the Maintenance Rule were noted (Section E4).

Report Details

Summary of Plant Status

Units 1, 2, and 3 were at 100 percent power.

Introduction

The primary focus of this inspection was to verify that the licensee had implemented a maintenance monitoring program which satisfied the requirements of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," (the Maintenance Rule). The inspection was performed by a team of inspectors that included four region-based inspectors, and a team leader and six observers from the Quality Assurance and Maintenance Branch, Office of Nuclear Reactor Regulation, and two observers from the Probabilistic Safety Assessment Branch, Office of Nuclear Reactor Regulation.

I. Operations

04 Operator Knowledge and Performance

04.1 Operator Knowledge of Maintenance Rule

a. Inspection Scope (62706)

During the inspection, the inspectors interviewed licensed operators to determine if they understood the general requirements of the Maintenance Rule and their particular duties and responsibilities for its implementation. The inspectors asked a sample of operators to explain the general requirements of the Maintenance Rule and to describe their responsibilities for implementing these requirements. The inspectors also reviewed the program dealing with licensed operator system approach to Maintenance Rule training.

b. Observations and Findings

The tasks associated with the Rule that operators were responsible for included:

- Determining the impact on availability of structures, systems, and components when tagging equipment out-of-service and performing administrative requirements for tagging.

- Determining structures, systems, and components out-of-service logging requirements and impact on availability.

- Evaluating priorities for system restoration.

- Evaluating job scheduling activities.

- Evaluating plant configuration to determine if work authorization created undue risk.

Operators understood the required duties for Rule implementation, which included logging in- and out-of-service equipment within the scope of the Rule and assessing the risk of emergent work items in accordance with the plant configuration risk indicator matrix. The inspectors reviewed selected operator logs for July 16 and 17, 1996, and verified Maintenance Rule availability log entries were being made as required. The inspectors verified the matrix was readily available to operators on Unit 2.

Although operators were knowledgeable of their duties associated with implementation of the Rule, the inspectors did not consider operators interviewed to be familiar with the purpose of the Rule. For example, when asked what the purpose of the Rule was, operators indicated the Rule would improve plant safety. However, they did not indicate the Rule was used to monitor performance of structures, systems, or components against goals or performance criteria and take appropriate corrective actions when goals or performance criteria were not met.

The inspectors also reviewed the training materials and noted that they appeared to reasonably address the operation's staff responsibilities. The training department management representative stated that training had been provided to the operators.

c. <u>Conclusions</u>

Licensed operators understood their specific duties and responsibilities for implementing the Maintenance Rule. However, general understanding of Maintenance Rule was weak.

II. Maintenance

M1 Conduct of Maintenance (62706)

M1.1 <u>Scope of Structures, Systems, and Components Included Within the Rule</u>

a. <u>Inspection Scope (62706)</u>

Prior to the onsite inspection, the inspectors reviewed the Palo Verde Final Safety Analysis Report and Emergency Procedures Guidelines and selected an independent sample of structures, systems, and components that the inspectors believed should be included within the scope of the Maintenance Rule. Structures, systems, and components scoping criteria are described in 10 CFR 50.65 (b). During the onsite review, the inspectors used this list to determine if the licensee had adequately identified the structures, systems, and components that should have been included in the scope of their program.

b. <u>Observations and Findings</u>

The licensee appointed an expert panel to perform several Maintenance Rule implementation tasks including establishing the scope of the Maintenance Rule. They reviewed the 128 systems in the plant and determined that 89 structures, systems, and components were in the scope of the Rule.

The inspectors reviewed the licensee's database and verified that all required structures, systems, and components were included within the scope of the Rule except the radwaste building. The radwaste building is a nonsafety-related structure. However, in the licensee's scoping matrix, the radwaste building was listed as safety-related but not within the scope of the Rule. The inspectors noted that the radwaste building contained certain safety-related equipment and that failure of the radwaste building could result in the failure of these safety-related structures, systems, and components.

After some discussion, the licensee determined that the radwaste building should be included within the scope of Rule. The licensee stated that adding the radwaste building to the scope of the Maintenance Rule would not have an impact on their program because all the structures came under their structural monitoring program, which was used to implement the Maintenance Rule.

c. <u>Conclusions</u>

All required structures, systems, and components (except the radwaste building) were included within the scope of the Rule. After discussions with the inspectors the licensee included it within the scope of the Rule.

M1.2 <u>Safety (or Risk) Determination</u>

a. <u>Inspection Scope</u>

Paragraph (a)(1) of the Rule requires that goals be commensurate with safety. Additionally, implementation of the Rule using the guidance contained in NUMARC 93-01, "Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," (which the licensee was using) required that safety be taken into account when setting performance criteria and monitoring under paragraph (a)(2) of the Rule. This safety consideration would then be used to determine if the structures, systems, and components should be monitored at the train or plant level. The inspectors reviewed the methods and calculations that the licensee had established for making these required safety determinations. The inspectors reviewed meeting minutes and attended an expert panel meeting. The inspectors also reviewed the safety determinations that were made for the systems that were reviewed in detail during this inspection.

b. Observations and Findings

The licensee established an expert panel in accordance with Section 9.3.1 of NUMARC 93-01, which described the use of the expert panel in the structures, systems, and components risk-determination process. Licensee Procedure 71DP-OEMO1, "Risk Management Program Expert Panel," Revision 0, described the licensee's program for evaluating risk for those structures, systems, and components within the scope of the Rule. The expert panel membership included representatives from maintenance support, probabilistic risk assessment, systems engineering, operations, scheduling and transient analysis. Alternates for each permanent member and Rules for a quorum were established. Additional engineering personnel were used on an as-needed basis. The expert panel possessed a total of 123 person-years of nuclear power experience.

In addition to determining which structures, systems, and components were within the scope of the Rule, the expert panel established risk significance ranking of structures, systems, and components; performance criteria of structures, systems, and components; goals of structures, systems, and components; and Category (a)(1) and (a)(2) structures, systems, and component lists. This use of the expert panel for these other activities, which were beyond the guidance in NUMARC 93-01, was considered to be a strength.

The final risk significance ranking was derived from a combination of probabilistic risk assessment data and expert panel judgment based on deterministic considerations. The licensee had used quantitative measures of risk achievement worth, Fussell-Vesely importance, and core damage frequency contribution. The risk rankings were both in terms of core damage frequency (Level 1 analysis) and large, early release frequency (Level 2 analysis). This original risk ranking identified 19 risk significant systems.

The licensee performed a self assessment (Audit Report 96-020) in May 1996 of its Maintenance Rule activities which identified that the process that had been used for the original risk ranking differed from the process specified in NUMARC 93-01. The licensee's management decided to perform the risk ranking process a second time using the methods recommended in NUMARC 93-01. These methods involved the use of an expanded interpretation of trip initiators and 90 percent core damage frequency contribution rather than the "Pareto Principle," which had been used in the earlier ranking process. This second risk ranking resulted in 16 additions to the high risk category for a total of 35 risk significant systems. The inspectors considered the self assessment, re-evaluation of risk determination and subsequent decision on the part of the expert panel to rank the additional structures, systems, and components as risk significant as a proactive and reasonable part of the on-going process of implementing the Rule.

After identifying the additional 16 risk significant systems, the licensee set a schedule for establishing system and train-level performance criteria for each of them following the NUMARC 93-01 guidance. At the time of the inspection, the licensee had established train-level performance criteria for 8 of the 16 additions to the high risk category, and was on schedule to complete the remaining 8 structures, systems, and components by September 5, 1996. The licensee appeared to have set a reasonable schedule for establishing performance criteria for these newly identified risk significant structures, systems, and components.

b.1 Risk Ranking Methodology

The inspectors reviewed the licensee's methodology for ranking structures, systems, and components which were within the scope of the Rule that followed the NUMARC 93-01 guidance. It was determined that the licensee had used the highest ranking component in each system as a surrogate for the system level importance. Thus, in determining the safety significance of a given system, the licensee assigned the Fussell-Vesely, risk achievement worth, or core damage frequency value of the highest ranked event as the value for the overall system importance. The inspectors concluded that this approach might not in all cases reflect the true "system" importance. For example, certain systems could have all the individual system components ranked slightly below the NUMARC 93-01 cutoff values, yet the system as a whole would be of greater importance than the single most important component. This effect could be observed empirically by manipulating the model and adjusting the relevant parameters of all of the system components according to the importance measure of interest and then recalculating the core damage frequency to reflect the "system" level importance. However, the licensee's software capabilities posed difficulties in calculating the actual system level performance using this approach.

The inspectors observed that, for most systems, the assignment of system importance based on the highest ranked component would represent an acceptable approach to system-level ranking. However, for those systems which were slightly below the cutoff values, additional measures were not taken to ensure that the appropriate importance levels are assigned. In particular, the expert panel was not made aware of this issue in making the final determinations of risk significance. For those borderline systems in which the expert panel may have been divided as to whether the system should be ranked high or low, the licensee could have performed the required calculations in order to arrive at a more accurate analytical estimate of the system importance.

The licensee representatives acknowledged that under certain scenarios, the use of the highest ranked component as a surrogate for system importance might not provide an appropriate estimate of system-level importance and that certain refinements in their risk ranking process were warranted.

In general, the inspectors found the assignment of system importance based on the highest ranked component would represent an acceptable approach to system-level ranking based on component level importance measures.

b.2 Truncation

Truncation limits are imposed on probabilistic risk assessment models in order to limit the size and complexity of the results to a manageable level. However, the benefits of truncation must be weighed against the potential consequences in that, if truncation limits are set too high, then certain events may be truncated which could result in underestimations of the importance of the affected events.

The inspectors reviewed the truncation limits, which had been established by the licensee in the solution of their probabilistic risk assessment model. It was determined that the licensee had used a cutset matching type of approach, whereby, the system-level fault trees were solved at a truncation level of 1E-08 (with the exception of the low pressure safety injection trees which were solved at 5E-07) and the event trees were solved at a truncation level of 1E-09. It was determined that the licensee had not performed sensitivity studies to determine whether the final rankings would be significantly affected by varying the truncation levels. The licensee's representatives indicated that such studies would represent an enormous analytical burden due to the nature of the calculations and their software capabilities.

The inspectors independently investigated the truncation effects on the final rankings and found that at least one additional system, Non-Class 1E instrument ac power would have exceeded the cutoff values for both Fussell-Vesely and risk achievement worth using the licensee's philosophy of assigning system-level importance to the highest ranking component within that system when a truncation level of 1E-12 was used. However, the inspectors noted that the licensee's expert panel had included the Non-Class 1E instrument ac power system among the high risk systems even though its Fussell-Vesely and risk achievement worth values were below the cutoffs. (The Non-Class 1E instrument ac power system did, however, rank in the top 90 percent core damage frequency cutset list). The inspectors determined that the licensee's approach to truncation with respect to the ranking process was adequate. Even though the expert panel's function was to compensate for probabilistic risk assessment limitations, the reliance on the panel to compensate for the lack of probabilistic risk assessment sensitivity studies was viewed as an area in which improvements could be made, such as sensitivity studies to validate that the final rankings would not be affected by truncation levels.

The inspectors determined that the licensee's approach to truncation with respect to the ranking process was adequate.

b.3 Performance Criteria

The inspectors reviewed the licensee's performance criteria which had been established for structures, systems, and components monitored under paragraph (a)(2) of the Maintenance Rule. It was determined that while the probabilistic risk assessment data and assumptions comprised an important input into the establishment of the criteria, it could not be demonstrated that the assumptions and data had been preserved in all cases. Thus, the potential existed that if certain structures, systems, and components reached or exceeded their performance criteria, the risk ranking results might be different from what was obtained in the original ranking. For example, the probabilistic risk assessment used an assumed maintenance unavailability probability for the gas turbine generators of 6E-03. However, the licensee's Maintenance Rule performance criteria used a value of 2E-01. The inspectors noted that this difference (for a single structure, system, and component) did not significantly affect the rankings. It was unclear, however, how the cumulative effects of many such differences would affect the ranking process when considered in the aggregate (i.e., if the performance criteria for many structures, systems, and components varied significantly from the probabilistic risk assessment data). It appeared that the licensee did not have a mechanism for feedback of the selected, probabilistic risk assessment-based performance criteria into the ranking process to ensure that the ranking results would not be affected by performance criteria which differed from that used in the probabilistic risk assessment.

The inspectors found that performance criteria were adequate. However, not incorporating the effects of reliability and unavailability assumptions (different from those assumed in the original ranking) was a weakness of the overall risk ranking methodology.

b.4 Use of Bayesian Updating Methodology

The inspectors noted that the licensee had used a Bayesian updating process to incorporate certain aspects of plant-specific data into the probabilistic risk assessment model for 22 structures, systems, and components. These were selected using a Birnbaum risk importance measure. It was determined that while the licensee had used a recognized methodology for performing such updating, the method used provided a very crude approximation of the results which would be achieved by more rigorous methods. The licensee had assumed lognormal prior distributions for the data to be updated using the Bayesian methodology. In order to perform the necessary calculations by hand, the licensee "fitted" a gamma distribution to the lognormal prior distribution using the "method of moments." This process preserved the mean and variance of the prior distribution, however, significant distortions can result. Data for 5 of the 22 selected structures, systems, and components were affected by this method.

This was illustrated by the licensee's updating of the frequency of the loss-of-turbine cooling water initiating event. The licensee's initial estimate for the frequency of loss-of-turbine cooling water initiating event was 2E-02/yr based on generic data (i.e., one occurrence every 50 years). An error factor of 14 was used by the licensee to estimate the variance of the prior distribution. By pooling plant-specific data across all three units, the licensee determined that no losses of turbine cooling water had occurred during 27.8 years of plant operation. Using the method of moments approximation as described above, the licensee updated the generic data and obtained a new mean frequency for loss-of-turbine cooling water initiating event of 2.6E-03/yr (i.e., one occurrence every 385 years). The inspectors determined that this result was not supported by the observed data.

Better approaches to updating generic data with plant-specific information were available. Such approaches include approximations, which preserve the desired probability intervals of the prior distribution, and numerical methods, which solve the updating problem directly. Independent calculations by the inspectors using these alternative methods and the licensee's data yielded an updated estimate of the loss-of-turbine cooling water initiating event frequency to be approximately 1E-02/yr (i.e., one occurrence every 100 years). The effect of these different estimates would be seen in the risk ranking results. In the case of loss-of-turbine cooling water initiating event, the impact of the different initiating event frequency estimates would have been to elevate the importance of turbine cooling water so that the NUMARC 93-01 cutoff values for high risk significance would be exceeded. (It should be noted that the licensee's expert panel had independently assessed the turbine cooling water system to be low risk.)

The licensee's representatives agreed that the method of moments approximation approach could yield potentially distorted results when updating lognormal distributions, particularly those with relatively large error factors. The licensee's representatives stated that a review of the Bayesian methodology and its effects on the risk ranking results would be conducted to ensure that no other underestimations had occurred.

The inspectors concluded that even though the licensee's method of updating probabilistic risk assessment data using plant-specific data represented a mathematically acceptable approach, the method employed could, in some cases, distort the results due to the approximations which had been used.

The licensee's representatives agreed with the inspectors' assessment and stated that an alternate approach using numerical methods would be considered.

b.5 Expert Panel Observation

The inspectors observed the deliberations of the licensee's expert panel meeting on July 18, 1996. The agenda included a discussion on performance criteria of structures in general and specific classification of the radwaste building structure as Category (a)(2), the impact of reliability and unavailability performance criteria on probabilistic risk assessment assumptions, and the review of system basis documents.

The discussions of the expert panel reflected an in-depth review of the subjects and the major issues impacted by the Maintenance Rule. The inspectors found that expert panel was a strength of the licensee's program.

c. Conclusion

The risk determination was being performed in a manner consistent with the guidance of NUMARC 93-01. Some weaknesses were noted.

M1.3 Periodic Evaluation

a. Inspection Scope

Paragraph (a)(3) of the Rule requires that performance and condition monitoring activities and associated goals and preventive maintenance activities be evaluated taking into account, where practical, industry-wide operating experience. This evaluation is required to be performed at least one time during each refueling cycle, not to exceed 24 months between evaluations. The inspectors reviewed the plans and procedures the licensee had established to ensure this evaluation will be completed as required. The inspectors also discussed these plans with the licensee's Maintenance Rule coordinator who was responsible for performing this evaluation.

b. Observations and Findings

At the time of the inspection, the licensee was not required by the Rule to have performed the first periodic evaluation. However, the licensee had established plans and procedures for performing these evaluations and had performed two evaluations prior to the inspection. The inspectors reviewed one of these evaluation reports (emergency lighting system) and noted that it appeared to meet the requirements of the Rule. The evaluation noted a declining performance trend with the system's Haloplane batteries. Because the performance of the Haloplane batteries had exceeded the reliability trigger (4 failures in 21 demands) it was categorized as Category (a)(1). The licensee planned to replace the Haloplane batteries with a new design within the next 2 years.

The inspectors also noted that preventive maintenance activities were being adjusted as required by paragraph (a)(3) whenever a goal or performance criteria was exceeded or whenever a structure, system, or component experienced a maintenance preventible functional failure. These ongoing adjustments, in lieu of periodic, was considered a strength of the licensee's program.

c. Conclusions

Plans and procedures for performing the periodic evaluation appeared to meet the requirements of the Rule.

M1.4 Balancing Reliability and Unavailability

a. Inspection Scope

Paragraph (a)(3) of the Rule requires that adjustments be made, where necessary, to assure that the objective of preventing failures through the performance of preventive maintenance is appropriately balanced against the objective of minimizing unavailability due to monitoring or preventive maintenance. The inspectors reviewed the plans and procedures the licensee had establishea to ensure this evaluation was completed as required. The inspectors also discussed these plans with the licensee's Maintenance Rule coordinator who was responsible for performing this evaluation.

b. Observations and Findings

The licensee's approach of balancing equipment reliability and unavailability consisted of establishing goals and/or performance criteria for the appropriate structures, systems, and components and then monitoring the performance of the affected equipment. An implicit assumption was made that if appropriate goals and criteria were set, and if such goals and criteria were met, then an appropriate balance between unavailability and reliability would be achieved. The results of the overall process would then be evaluated during the required periodic assessments of maintenance program effectiveness.

The inspectors concluded that such an approach should provide a reasonable balance, provided that appropriate goals and performance criteria were always established. The inspectors noted that the licensee's performance criteria did not always preserve the original probabilistic risk assessment assumptions (see the discussion regarding performance criteria). Thus, while the inspectors determined that the licensee's approach to balancing reliability and unavailability was reasonable, the use of goals and performance criteria that differed from the original probabilistic risk assessment assumptions could limit the effectiveness of this approach.

c. Conclusions

The licensee's approach to balancing reliability and unavailability was reasonable, however, the use of goals and performance criteria that differed from the original probabilistic risk assessment assumptions could limit the effectiveness of this approach.

M1.5 Plant Safety Assessments Before Taking Equipment Out-of-Service

a. Inspection Scope

The inspectors reviewed the licensee's processes for assessing the impact of equipment out-of-service during maintenance activities. Paragraph (a)(3) of the Maintenance Rule states that the total impact on plant safety should be taken into account before taking equipment out-of-service for monitoring or preventive maintenance. The inspectors reviewed the licensee's procedures and discussed the process with the Maintenance Rule coordinator, the expert panel members, operators, and maintenance schedulers.

b. Observations and Findings

The licensee had developed a matrix which identified combinations of equipment allowed to be taken out-of-service simultaneously. Both operators and the work scheduler used this matrix when assessing the safety impact of taking equipment and combinations of equipment out-of-service. Prior to conducting on-line maintenance, an analysis of plant conditions was performed. This analysis included reviews of operational logs to ensure that opposite train equipment or support equipment was not degraded. The results may include decisions to accelerate return-to-service of equipment versus continuation of the equipment out-of-service condition, as scheduled.

The licensee's matrix consisted of various combinations of equipment outages which had been partially pre-analyzed by manipulation of the probabilistic risk assessment model. The matrix also identified configurations not allowed by Technical Specifications. The inspectors determined that the licensee had used their probabilistic risk assessment model to calculate the conditional core damage probability of various systems being out-of-service. The cumulative effect of any two systems being out-of-service was estimated by summing the two conditional core damage probabilities which represented the intersection of the desired configurations (i.e., each axis of the matrix represented a single conditional core damage probability) and then comparing this sum to a predetermined criterion. The comparison represented the relative risk significance of the resulting configuration.

The inspectors noted that there was no analytical basis for the summation of two conditional core damage probabilities. Further, the inspectors concluded that this type of approach would not, in all cases, yield conservative estimates of the true risk associated with a given configuration. In particular, when the two configurations represented at the intersection of the matrix axes were not totally independent, and such an approach could underestimate the risk involved in the configuration. Conversely, when the two configurations were independent, an over estimation of the risk could result. The licensee's representatives agreed that when a dependency existed between the configurations of interest then the approach of summing the conditional core damage probabilities would be nonconservative. The licensee's representatives agreed to review the matrix and ensure that none of the risk estimates, which had been derived by summing the conditional core damage probabilities, were the result of dependent configurations.

In addition to concerns related to the underlying basis of the matrix, the inspectors determined that the licensee's approach to assessing configurations not specifically addressed by the matrix was weak. The licensee's guidance for use of the matrix indicated that if a given configuration was not specifically addressed by the matrix then the new configuration would not represent any additional risk from a nuclear safety standpoint (i.e., note on page 7 of Procedure 30DP-9MTO1, "Assessment of Risk When Performing Maintenance," Revision 3). The inspectors challenged this assertion, and the licensee representatives indicated the procedural guidance may have been misleading. The licensee representatives indicated that maintenance on other (balance-of-plant) systems not governed by the matrix was conducted in accordance with their trip reduction program. Given that few balance-of-plant systems were specifically addressed by the matrix, the inspectors questioned whether the matrix would be of significant value in evaluating relatively high maintenance periods when more equipment was out-of-service than was addressed by the matrix. The licensee's representatives agreed that the matrix would be of limited use in evaluating such configurations. The licensee's representatives stated that further reviews would be conducted to ascertain the risk significance of conducting maintenance activities on systems and configurations which were not addressed by the matrix.

The matrix was used for Modes 1, 2, and, in part, for Mode 3. For the remaining modes of operation, the licensee had established a procedure which followed the guidelines of NUMARC 91-06, "Guidelines for Industry Actions to Assess Shutdown Management."

The inspectors concluded that the licensee's method of assessing the impact of equipment out-of-service was generally adequate. However, the weaknesses which were noted could limit the effectiveness of this approach. The lack of comprehensive coverage of balance-of-plant systems (in conjunction with important safety systems) would restrict the range of normal plant maintenance configurations which could be addressed by the matrix. Additionally, even though the inspectors did not explicitly identify a matrix configuration which exhibited a dependency between the two axes (i.e., systems out-of-service), any such dependency could lead to a nonconservative estimate of the risk associated with that particular configuration. The licensee's representatives agreed with the inspectors' observations and conclusions and indicated that improvements would be made to the matrix.

c. <u>Conclusion</u>

The performance of plant safety assessments before taking equipment out-of-service was generally adequate. However, there may be a weakness in the matrix that was used to perform these assessments because some balance-of-plant systems were not modeled in the probabilistic risk assessment.

M1.6 <u>Goal Setting and Monitoring and Preventive Maintenance</u>

a. <u>Inspection Scope</u>

The inspectors reviewed program documents and records in order to evaluate the process that had been established to set goals and monitor under paragraph (a)(1) and to verify that preventive maintenance was effective under paragraph (a)(2) of the Rule. The inspectors also discussed the program with the Maintenance Rule coordinator, system engineers, maintenance engineers, schedulers and operators.

The inspectors reviewed the systems described below to verify: that goals or performance criteria were established with safety taken into consideration; that industry-wide operating experience was considered where practical; that appropriate monitoring and trending was being performed; and, that corrective action was taken when structures, systems, or components failed to meet goal or performance criteria, or when a structure, system, or component experienced a maintenance preventible functional failure.

b. Observations and Findings

b.1 Safety Consideration in Setting Goals and Performance Criteria

The Maintenance Rule as implemented using the guidance in NUMARC 93-01 requires that safety (risk) be taken into consideration when establishing goals under paragraph (a)(1) or performance criteria under paragraph (a)(2).

At the time of the inspection, the licensee had 10 structures, systems, and components in Category (a)(1). The inspectors noted that in addition to placing structures, systems, and components in Category (a)(1) when they had exceeded their performance criteria or experienced maintenance preventible functional failures, the licensee also placed any structures, systems, and component which experienced a functional failure into Category (a)(1). For example, some structures, systems, and components that were in Category (a)(1) were there because of design deficiencies. The inspectors found this to be a conservative approach to implementing the Rule.

The licensee's expert panel used the risk determination process described in Section M1.2 to assess the relative risk of all structures, systems, and components within the scope of the Rule. The results of this process were used to categorize structures, systems, and components as either high risk significant or low risk significant. System or train-level performance criteria were established for all high risk significant systems and those low risk significant systems in standby service except as noted below. Plant-level performance criteria were established for all other structures, systems, and components (i.e., low risk significant normally operating systems).

Additionally, the licensee did not use the run-to-failure or inherently reliable classification of structures, systems, and components; therefore, either goals or performance criteria were established for all structures, systems, and components.

(1) Containment Structure

Based on discussions with engineers within the licensee's maintenance services civil engineering group and review of their procedures, the inspectors determined that the licensee's monitoring program for structures included performing walkdowns of selected zones of structures each year. The engineers stated that all structures were included in the structures monitoring program. The engineers stated that at least a portion of a containment structure would be inspected annually. Aggregation of the samples selected each year would result in a representative sample of all areas of the plant being examined over a 10-year period. Discrepancies identified would be addressed individually under their program. The inspectors found that the licensee had established reasonable schedules for monitoring structures.

The licensee used knowledgeable and experienced civil engineers to perform these structural inspections. This practice was considered by the inspectors to be a strength of their program. However, the inspectors were concerned that the licensee had not identified specific performance criteria to be considered when performing these inspections. The licensee's representatives considered their performance criteria to be all the industry codes and standards which formed the design bases for construction of the plant. The inspectors found that the use of the design basis documents as performance criteria to be impractical because: (1) there are numerous, perhaps hundreds, of specifications in these documents all of which, arguably, could be considered performance criteria; and (2) many of the specifications contained in the design basis documents, such as rebar spacing, can only be verified during construction. The licensee had failed to select specific, appropriate, and verifiable performance criteria from those contained in the design basis and had failed to document them in a structural inspection procedure.

In addition to the use of design bases information instead of specific performance criteria, the licensee's process had no clear guidance for determining when existing preventive maintenance was inadequate and goals needed to be established under paragraph (a)(1) of 10 CFR 50.65. The minutes for the January 4, 1996, expert panel meeting documented that the licensee chose not to establish specific performance criteria or functions for structures. The meeting minutes also documented that a decision to place a structure into Category (a)(1) would be based on an annual review of deficiencies identified. This decision to defer consideration of placing the structure in Category (a)(1) until the annual review is contrary to NUMARC 93-01, which requires the review be done on an ongoing basis.

The inspectors found that the use of design bases information instead of specific performance criteria for structures and the use of unclear guidance for ensuring that structures will be moved to Category (a)(1), when required, were significant weaknesses in the licensee's program for implementing the Maintenance Rule. However, the licensee was effectively monitoring all plant structures and taking actions when problems were identified. At the exit meeting, the licensee stated that they would: establish specific performance criteria within 90 days; and review, and if necessary, revise their procedures to clarify when structures should be moved to Category (a)(1). This issue is an unresolved item pending further NRC review (50-528;529;530/96009-01).

(2) Pressurizer and Reactor Vessel Vent System

Prior to the implementation of the Maintenance Rule, Unit 1 had experienced two instances of performance problems with 1-inch, solenoid-operated valves in the pressurizer and reactor vessel vent system. The inspectors asked if these failures would have been considered functional failures (as indicated in Section M1.6 of this report, the licensee tracked functional failures in lieu of maintenance preventible functional failures), if the Maintenance Rule had been in effect at the time. The licensee representative stated that screening for functional failures would be conducted when reliability and unavailability data were collected and as part of the quarterly failure trend report. The inspectors emphasized to the licensee that functional failures were an important element for moving structures, systems, and components into Category (a)(1) and, therefore, must be identified as part of the root-cause determination process and not wait until the quarterly failure trend report is issued. Licensee representatives stated that they intended to identify additional controls to improve the process of identifying and evaluating maintenance preventible functional failures.

The inspectors found that licensee reviews to identify functional failures for the pressurizer and reactor vessel vent system were not performed in a timely manner.

(3) Steam Bypass Control

The performance criterion for the steam bypass control system was established at the plant level rather than at the system or train level as required for risk significant systems. The inspectors discussed this issue with the system engineer who agreed that the current performance criterion was a plant-level performance criterion. However, the system engineer had not taken credit for other system-level monitoring activities and corrective actions that were performed to resolve the apparently random electronic failures in the steam bypass control system.

The inspectors reviewed these additional monitoring activities and corrective actions and noted that they were the type that were appropriate for monitoring at the system-level under the Maintenance Rule.

The inspectors found that the licensee should have taken credit for those system-level monitoring activities and corrective actions as performance criterion rather than the plant level performance criterion and monitoring.

(4) Feedwater Control System

The licensee placed the feedwater control system in Category (a)(1) due to a decreasing trend in reliability, which the licensee determined to be a design problem. The inspectors reviewed the failure history and noted that most failures of the system had been due to apparently unrelated failures of various electronic components. The corrective actions taken for each of the failures appeared to be reasonable. Despite extensive troubleshooting, the licensee was unable to identify any specific common cause for the failures other than aging. To address the aging issue, the system engineer submitted a proposal to licensee management that the existing analog feedwater control system be replaced with a new digital system.

In the interim period while this proposal was being considered, the expert panel established a Category (a)(1) goal for the feedwater control system of no unplanned scrams due to failures of the feedwater control system, which was the same as the previously established Category (a)(2) plant-level performance criterion. Normally the goals set under Category (a)(1) should be specifically directed at addressing the problem which caused the failures. However, in this case, the licensee had performed extensive tests and monitoring activities, had evaluated industry-wide operating experience, had discussions with the system vendor and other licensees with similar systems, and had not identified any specific cause of the problems other than aging of the analog system. Consequently, the goal that was set appeared to be appropriate.

The inspectors found that the cause determination was thorough and the planned corrective action and goal were appropriate.

(5) Gas Turbines

The licensee placed the gas turbine system in Category (a)(1) due to repeated failures to start during tests. The inspectors reviewed the causes of the start failures with the licensee's representatives and noted that a specific component (air start pressure regulator) had been identified as the cause of most failures. Corrective actions had been taken for the component and start failures had decreased. In addition, specific Category (a)(1) goals were established for the component to assure the problem had been corrected. The licensee was placing appropriate focus on potential multiple recurring failures.

The inspectors also noted that the unavailability goal of 20 percent was not consistent with the probabilistic risk assessment and individual plant evaluation assumptions or recent unavailability data of 0.6 percent. However, an independent review by the inspectors and discussions with licensee staff indicated that an assumed unavailability of 20 percent would not have a significant impact on the probabilistic risk assessment and individual plant evaluation results.

The inspectors found that goals were reasonable and were set commensurate with safety. Corrective actions were also reasonable.

(6) Reactor Coolant Pumps

The licensee had recently placed the reactor coolant system for Unit 1 in Category (a)(1) as a result of performance problems with reactor coolant pump shafts cracking due to fatigue failure. The licensee was collecting pump vibration data and analysis was being conducted to identify any impending pump shaft failure. The planned corrective action was to replace Unit 1 pump shafts that were vulnerable to fatigue failure. In addition, the licensee had been monitoring the unplanned capability loss factor and had set a unit goal of less than 2.7 percent. Loss of capability factor was a plant-level goal and was used because pump shaft replacement prior to a scheduled outage would be reflected in unplanned capability loss factor. Interviews with licensee personnel revealed that the nuclear safety aspects of a catastrophic shaft failure had been considered for goal setting.

The inspectors found that goals were reasonable and set commensurate with safety.

(7) Steam Generator Tubes

The reactor coolant system had also exhibited performance problems related to steam generator tube failures. The licensee had been monitoring tube reliability by inspecting for defects through eddy current data acquisition and analysis. The performance criterion was no tube cracks or defects that would compromise structural integrity. After the tube failure on the Unit 2 steam generator, the licensee decided to place the reactor coolant system in Category (a)(1).

Discussions with licensee personnel indicated that safety (risk) significance was considered in setting the goals for the steam generators. To correct the steam generator tube degradation problems, the licensee had initiated an effort to significantly improve steam generator chemistry, as well as other initiatives. During interviews, licensee personnel expressed confidence that Unit 2 reactor coolant system would be returned to Category (a)(2) in the near future.

The inspectors found that goals were reasonable and set commensurate with safety.

(8) High and Low Pressure Safety Injection

The reliability and unavailability goals for the high and low pressure safety injection systems (low pressure safety injection and high pressure safety injection) were based on the reliability and unavailability assumed in the licensee's probabilistic risk assessment. Separate reliability criteria were established for the shutdown cooling portion of the safety injection system not captured by the goals for the low pressure injection system. The goals and monitoring were appropriate for the systems which were placed under Category (a)(1) due to design deficiencies.

The inspectors found that the goals were reasonable and set commensurate with safety.

(9) Non-Class 1E AC Instrumentation Power

While working on a plant modification to replace the automatic bus transfer device with a faster acting device (discussed below) the licensee had established an interim goal which took safety into consideration.

The inspectors found that the goal was reasonable and set commensurate with safety and that corrective actions were reasonable.

(10) Pressurizer Safety Valves

All three units at Palo Verde had experienced pressurizer safety valve setpoint failures that were identified during outage offsite testing. The licensee's program had established performance criteria by setting a reliability trigger value of 95 percent. Functional failure had been defined as setpoint drift outside the analyzed acceptable setpoint range and test failures versus test attempts were being tracked.

The inspectors found that the performance criteria were reasonable and set commensurate with safety.

(11) Auxiliary Feedwater System

The auxiliary feedwater system was being monitored under Category (a)(2) using train-level performance criteria which were based on probabilistic risk assessment reliability and unavailability. The auxiliary feedwater system had been recently returned to Category (a)(2) after a modification to all three units had significantly increased turbine-driven pump reliability.

The inspectors found that performance criteria were reasonable and were set commensurate with safety.

(12) Emergency Diesel Generators

The emergency diesel generators were being monitored under Category (a)(2) using system or train-level performance criteria which were based on probabilistic risk assessment reliability and unavailability.

The inspectors found that performance criteria were reasonable and were set commensurate with safety.

(13) Charging Pumps

Performance criteria for chemical and volume control charging pumps were based on engineering judgement because charging pump reliability and unavailability had not been explicitly modeled in the probabilistic risk assessment.

The inspectors found that performance criteria were reasonable and set commensurate with safety.

b.2 Use of Industry-Wide Operating Experience

The Maintenance Rule, as implemented using the guidance in NUMARC 93-01, requires that industry-wide operating experience be taken into consideration, where practical, when establishing goals under paragraph (a)(1) or performance criteria under paragraph (a)(2).

Based on review of documentation and discussions with licensee personnel, the inspectors determined that the licensee had established programs for reviewing and evaluating operational experience. NRC information notices, bulletins, and other operating experience information were routinely routed to the system engineers who had the responsibility for establishing performance criteria for their assigned systems.

The inspectors' review of the goals and performance criteria that had been set for the systems indicated that industry operating experience information had been appropriately taken into account when setting performance criteria. In the case of the emergency diesel generator system, the inspectors noted extensive licensee engineering interface with the diesel engine vendor and the owner's group for Cooper-Bessemer engines.

b.3 Monitoring and Trending

The statements of consideration for the Maintenance Rule indicate that, where failures are likely to cause loss of an intended function, monitoring should be predictive in nature and provide early warning of degradation. The licensee had assigned responsibility for trending and evaluating the performance of systems to the system engineers.

The inspectors reviewed the documentation for the selected systems and noted that some predictive monitoring and trending had been performed. Many of the system and train-level performance criteria were based on either the unavailability or reliability data used in the licensee's probabilistic risk assessment. Performance criteria and goals were established by the expert panel and recorded in system bases documents. Where performance criteria for a system or train were exceeded, or where a repetitive failure occurred, the licensee established goals, as required by paragraph (a)(1) of the Rule. The licensee had established "triggers," which were more conservative than the performance criteria. Performance was trended and when performance degraded or exceeded the trigger value, the licensee placed the system in Category (a)(1).

Originally there were five structures, systems, and components in Category (a)(1). At the time of this inspection, there were 10 structures, systems, and components in Category (a)(1). The remainder of the structures, systems, and components are in Category (a)(2). Only one system had moved from Category (a)(1) to (a)(2), namely the auxiliary feedwater system.

The inspectors also noted that the licensee used a centralized data collection group to help ensure uniformity and consistency. This group issued a quarterly failure trend report to identify structure, system, and component performance issues. In addition to collecting failure to start data, this group also collected data on the number of demands for much of the standby equipment. The inspectors noted that the collection of demand data in addition to failure data could considerably improve the licensee's ability to calculate equipment reliability. The inspectors considered this to be a strength of the licensee's program.

b.4 Corrective Actions

The inspectors reviewed the licensee's process and procedures for establishing corrective actions. The inspectors reviewed the corrective actions that were taken for the sample of systems that are listed in Section M1.6 of this report and interviewed each of the maintenance or system engineers who had primary responsibility for performing the root cause determination and establishing the corrective actions. The results of this review for some of those systems are described below.

(1) Non-Class 1E AC Instrumentation Power

The licensee had placed the nonsafety, non-class 1E ac instrumentation power system in Category (a)(1) because the system performance had resulted in reactor trips. Trips had resulted from a loss of power to the feedwater control system when the on-line source of power had been lost due to perturbations in the electrical system. Licensee engineering personnel identified that an automatic bus transfer device had not transferred to the alternate power source quickly enough to prevent the feedwater system from tripping. Additional cause determination and evaluation identified that the automatic bus transfer was designed to transfer to another stable power source within 500 milliseconds.

This was too slow to sustain the operation of the feedwater system, which required the transfer to be completed within 120 milliseconds. Engineering personnel developed a modification to install a faster acting automatic bus transfer. In the interim, the system lineup was changed to use the most reliable source as the normal source, and the frequency of preventive maintenance was increased. The system had been assigned a goal of less than two reactor trips in 18 months for each unit. According to engineering personnel this goal was sufficient to monitor system performance until such time as a generic modification was in place for all three units.

The inspectors found that the licensee had considered safety in the establishment of monitoring and goals. The licensee had in place an excellent process for the root cause evaluation. Corrective actions were appropriate. Maintenance and system engineers were very knowledgeable of their assigned systems and were proactive in the development and implementation of corrective actions.

(2) Pressurizer and Reactor Vessel Vent System

Unit 1 had experienced two instances of performance problems with 1-inch, solenoid-operated valves in the pressurizer and reactor vessel vent system. The first event occurred at power in November 1994 when two valves in series, RC-103 and 105, began cycling independently without a demand signal. The unit eventually had to be shutdown for a 5-day outage to refurbish the valves. During the most recent outage in April 1996, another system valve, RC-108, would not close on demand until the system lineup was changed to develop a differential pressure across the valve. The valve was refurbished and, subsequently, operated successfully. The licensee planned to refurbish all 21 valves, 7 per unit, on a three-outage basis. All valves in all three units were to be completed in 54 months.

The inspectors found that the root cause evaluation and corrective action were appropriate.

(3) Condenser

When a reactor trip was attributed to the loss of condenser vacuum due to a solenoid valve leaking air, the cause was determined to be aging of the internal gaskets of the valve body. Using a conservative valve lifetime, the licensee planned to replace the valve every 6 years even though the valve's use was expected to be acceptable for about 9 years.

The inspectors found that the root cause evaluation and corrective action were appropriate.

(4) Safety Injection

The inspectors' review of three problems associated with the low pressure safety injection and the high pressure safety injection portions of the safety injection system indicated that the root cause evaluations and planned corrective actions were appropriate.

c. Conclusions

c.1 Safety Consideration in Setting Goals and Performance Criteria

Reasonable goals or performance criteria that took safety into consideration were set for the feedwater control system, gas turbines, reactor coolant pumps, steam generator tubes, high and low pressure safety injection systems, Non-Class 1E ac instrumentation power, pressurizer safety valves, auxiliary feedwater system, emergency diesel generators, and the chemical and volume control charging pumps.

The following exceptions were noted:

- The failure to establish any performance criteria for the shutdown cooling portion of the safety injection system was a violation of 10 CFR 50.65.

- The selected performance criteria for the containment and other structures and the lack of clear guidance for placing structures, systems, and components in Category (a)(1) or (a)(2) was a weakness and an unresolved item (50-528;529;530/9609-02).

- The use of a quarterly failure trend data collection report to identify functional failures for the pressurizer and reactor vessel and vent system was a weakness.

- The selected plant-level performance criteria and monitoring for the steam bypass control system that did not take credit for the ongoing system-level monitoring and corrective actions was a weakness.

c.2 Industry-Wide Operating Experience

Industry-wide operating experience had been appropriately taken into consideration when setting goals and performance criteria.

c.3 Monitoring and Trending

Predictive monitoring and trending of appropriate parameters was being performed. The use of a centralized data collection group (to help ensure consistency) and the collection of demand data (in addition to failure data) were considered strengths of the licensee's program.

c.4 Conclusions for Corrective Actions

Root-cause analysis and corrective actions appeared to be a strength of the licensee's maintenance program. Maintenance and system engineers were very knowledgeable of their assigned systems and proactive in the development and implementation of corrective actions related to their systems.

M2 Maintenance and Material Condition of Facilities and Equipment

a. Inspection Scope

In the course of verifying the implementation of the Maintenance Rule using NRC Inspection Procedure 62706, the inspectors performed walkdowns to examine the material condition of the following systems:

- Essential chilled water,
- Containment hydrogen control,
- Condensate,
- Safety injection system pump rooms,
- Emergency diesel generators,
- Gas turbines,
- Feedwater control system,
- Class 1E 125 volt dc power,
- Steam bypass control, and
- Non-class 1E instrument power.

b. Observations and Findings

The inspectors found that the systems inspected appeared to be free of corrosion; oil leaks; water leaks; trash; and based on their external condition, well maintained. The gas turbines appeared to be particularly well maintained. However, identification and corrective action for small leaks on components could be improved. One example identified by the inspectors was a small leak on a fuel line on one of the Unit 2 emergency diesel generator day tank rooms.

c. Conclusions

In general, the material condition of the selected systems examined during the inspection was satisfactory. The material condition of the gas turbines was very good.

M7 Quality Assurance in Maintenance Activities

M7.1 Licensee Self Assessment

a. Inspection Scope

The inspectors reviewed the licensee's Audit Report 96-020, "Integrated Self-Assessment of PVNGS Maintenance Rule Program," dated May 31, 1996.

b. Observations and Findings

The audit was comprehensive and identified both good performance areas and areas in need of management attention. Several areas in need of attention were obvious to the inspectors during this inspection. Examples were personnel, other than middle managers, not being aware of their specific roles and responsibilities with regards to the Maintenance Rule. This was noted during interviews with both engineering and operations personnel. All findings were entered into the licensee's corrective action program for appropriate disposition and several corrective actions had been implemented.

c. Conclusions

The inspectors concluded the audit scope was comprehensive, and provided meaningful feedback to management.

III. Engineering

E2 Engineering Support of Facilities and Equipment

E2.3 Review of Updated Final Safety Analysis Report (UFSAR) Commitments

A recent discovery of a licensee operating their facility in a manner contrary to the UFSAR description highlighted the need for a special focussed review that compares plant practices, procedures and/or parameters to the UFSAR descriptions. While performing the inspections discussed in this report, the inspectors reviewed the applicable portions of the UFSAR that related to the areas inspected. The inspectors verified that the UFSAR wording was consistent with the observed plant practices, procedures and/or parameters.

E4 Engineering Staff Knowledge and Performance

E4.1 Engineers Knowledge of the Maintenance Rule

a. Inspection Scope (62706)

The inspectors interviewed licensee engineers within both the nuclear engineering and maintenance organizations to assess their understanding of the Maintenance Rule and associated responsibilities.

b. Observations and Findings

All maintenance and system engineers interviewed were very knowledgeable of their assigned systems and demonstrated sufficient knowledge to adequately implement their responsibilities under the Maintenance Rule. However, weaknesses among the engineering staffs were identified during interviews in the following areas:

- Understanding of what constituted a functional failure. One engineering supervisor incorrectly believed that a functional failure could only result from a failure on demand. In addition, the supervisor incorrectly believed that a spurious actuation of a ground fault relay which caused a low pressure safety injection valve to be inoperable would not be considered a functional failure under the Maintenance Rule. One system engineer did not recognize that failures caused by human actions could be considered functional failures under the Maintenance Rule. These misunderstandings of what constituted a functional failure were resolved by the end of the inspection. The inspectors did not identify any examples of a functional failure which had been misclassified.

- Understanding of how the performance criteria for systems were developed. Some system engineers did not have a clear understanding of how performance criteria for their systems were developed and how probabilistic risk assessment was used in the process.

- Understanding of engineering staff responsibilities in participating in the expert panel discussions. Most engineers did not recognize that they were a voting member of the expert panel in regards to structures, systems, and components for which they were responsible.

The issue of training was discussed with licensee management representatives. Previously the expert panel was primarily responsible for establishing performance criteria for each system. Recently the role of the maintenance and system engineers in the Maintenance Rule process had been expanded and training in the form of a self-study course was underway for many of the engineering staff.

c. Conclusions

All maintenance and system engineers interviewed were very knowledgeable of their assigned systems and demonstrated sufficient knowledge to adequately implement their responsibilities under the Maintenance Rule. However, some weaknesses in their knowledge of certain aspects of the Maintenance Rule and were noted.

V. Management Meetings

X1 Exit Meeting Summary

The inspectors discussed the progress of the inspection with licensee representatives on a daily basis and presented the inspection results to members of licensee management at the conclusion of the inspection on July 19, 1996. In addition, a supplemental telephonic exit was held on August 16, 1996, to discuss the enforcement findings from the inspection. The licensee acknowledged the findings presented.

The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

ATTACHMENT 1

PARTIAL LIST OF PERSONS CONTACTED

LICENSEE:

J. Bailey, Vice President
S. Bauer, Licensing Section Leader
S. Boardman, Maintenance Rule Project Manager
G. Box, Training Section Leader
P. Brandses, Department Leader, Maintenance
W. Ide, Director, Operations
J. Levine, Vice President
R. Lucero, Department Leader, Maintenance
D. Mauldon, Director, Maintenance
G. Overbeck, Vice President

NRC:

S. Black, Branch Chief
D. Carter, Resident Inspector
R. Frahm Jr., Reactor Engineer
D. Garcia, Resident Inspector
T. Gwynn, Director
D. Kelly, Contractor
J. Kramer, Resident Inspector
C. Petrone, Senior Reactor Engineer
W. Scott Jr., Sr. Reactor Engineer
J. Shackelford, Reliability & Risk Analyst
F. Talbot, Reactor Engineer
D. Taylor, Reactor Inspector
S. Tingen, Reactor Engineer
J. Wilcox Jr., Senior Operations Engineer

LIST OF INSPECTION PROCEDURES USED

IP 62706 Maintenance Rule

LIST OF ITEMS OPENED

Opened

50-528;529;530/96009-01 URI Performance criteria for the containment and other structures and guidance for placing structures, systems, and components in the Category (a)(1) and (a)(2). (Section M1.6.b.1(2)).

ATTACHMENT 2

LIST OF PROCEDURES REVIEWED

30DP-0MR01, "Maintenance Rule," Revision 0, May 24, 1996

71DP-0EM01, "Risk Management Program Expert Panel," Revision 0, May 24, 1996

13-NS-C09, "Maintenance Rule Scoping Study, Not Applicable (NA)," May 22, 1996

71IG-0EP01, "System-Level Risk Ranking Level," Revision 0, May 29, 1996

13-NS-C14, "Risk Significant Determination for Implementation of the Maintenance Rule," Revision NA, June 12, 1996

81DP-0ZZ01, "Civil Component Performance/Condition Monitoring," Revision 2, May 14, 1996

30IG-0MR01, "Performance Monitoring Instruction," Revision 0, May 24, 1996

70DP-0EE01, "Equipment Root Cause of Failure Analysis," Revision 6, May 31, 1996

73AC-0RA01, "Failure Data Trending and Nuclear Plant Reliability Data System," Revision 5, June 7, 1996

71IG-0EP02, "(a)(2) to (a)(1) Dispositioning and Goal Setting," Revision 0, June 11, 1996

30DP-9MP08, "Preventive Maintenance Basis Development," Revision 5, September 29, 1994

30DP-9MT01, "Assessment of Risk When Performing Maintenance," Revision 3, June 12, 1996

73ST-IZZ12, "Settlement Monitoring Program," Revision 1, June 23, 1995

71IG-0EP03, "Methodology Used By PRA Group/Expert Panel to Develop Unavailability and Reliability Performance Criteria For Systems, Trains and Components," Revision 0, June 12, 1996

13-NS-C23, "PRA (LERF) Risk Ranking Information for Maintenance Rule System Risk Ranking," Revision NA, April 9, 1996

13-NS-C08, "PRA of Transition Risk (Forced Shutdown)," Revision NA, March 20, 1996

13-NS-C13, "PRA (CDF) Risk Ranking Information for Maintenance Rule System Risk Ranking," Revision NA, May 16, 1996

13-NS-B39, "Safety Significance Analysis of Work During Maintenance Outage Windows," Revision NA November 1, 1995

90DP-0IP02, "Nuclear Administrative and Technical Manual, Investigation Methods," Revision 2, June 1989